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NATIONAL DAM INSPECTION PROGRAM. HEMLOCK LAKE DAM (NDI-PA 00399--ETC(U)
MAY 79

DACW31-79-C-0010

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DELMAR RIVER BASIN
TRIBUTARY BURN HILL CREEK, PIKE COUNTY

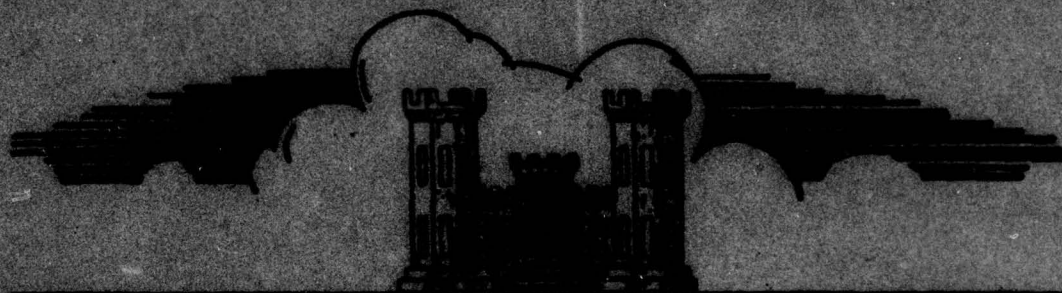
PENNSYLVANIA

HENLOCK LAKE DAM

NDI-PA 00399
PA DER 52-71

LEVEL 4

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



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Prepared By
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PHILADELPHIA, PENNSYLVANIA
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DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

MAY 1979

79-08-06-032

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11 May 79

DELAWARE RIVER BASIN

Name of Dam: Hemlock Lake Dam

County and State: Pike County, Pennsylvania

Inventory Number: PA 00399

15 DACW31-79-C-0010

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

6 National Dam Inspection Program.
Hemlock Lake Dam (NDI-PA 00399,
PA DER 52-71), Delaware River Basin,
Tributary Bush Kill Creek, Pike
County, Pennsylvania. Phase I Inspection Report.

Prepared by:

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

For:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

410 760 Jm

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

Accession For	
NTIS	GRA&I
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Unannounced	
Justification	
By	
Distribution/	
Availability Codes	
Dist.	Avail and/or special
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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Hemlock Lake Dam	ID # PA 00399
State Located:	Pennsylvania	
County Located:	Pike	
Stream:	Tributary of Bush Kill	
Coordinates:	Latitude 41° 17.6'	Longitude 75° 02.7'
Date of Inspection:	November 21, 1978	

ASSESSMENT

Hemlock Lake Dam is an earth embankment approximately 450 feet long and 14 feet high at its maximum section. The top of the dam is used as a golf course fairway; therefore, the width of 150 feet is many times wider than is necessary for purposes of stability. An ungated drop spillway is located adjacent to the right abutment (looking downstream). The 122 acre lake is used for recreation by the residents of Hemlock Farms.

Examination of the results of the hydrologic and hydraulic analyses indicates that the drop spillway is capable of passing 67 percent of the Probable Maximum Flood (PMF) without overtopping of the embankment. The Spillway Design Flood (SDF) for this "High" hazard structure is the PMF. Therefore, the drop spillway is classified as "Inadequate" but not "Seriously Inadequate" because it passes more than 50 percent of the PMF.

Based on visual observations and review of the information obtained from the Pennsylvania Department of Environmental Resources, Hemlock Lake Dam is in good condition. However, several items require attention:

1. There are some small trees on the upstream and downstream slopes of the embankment. The trees should be cut at ground level.
2. Several small animal burrow holes were observed on the embankment slopes. The holes should be filled with suitable materials.
3. The operating condition of the reservoir drain gate valve should be assessed and the valve should be operated periodically.

4. A warning system should be developed. During periods of heavy rainfall, the dam should be monitored and downstream residents alerted in the event of an impending failure.

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

Will M. Heiser

Will M. Heiser, P.E.
Vice-President
Pennsylvania Registration #00692

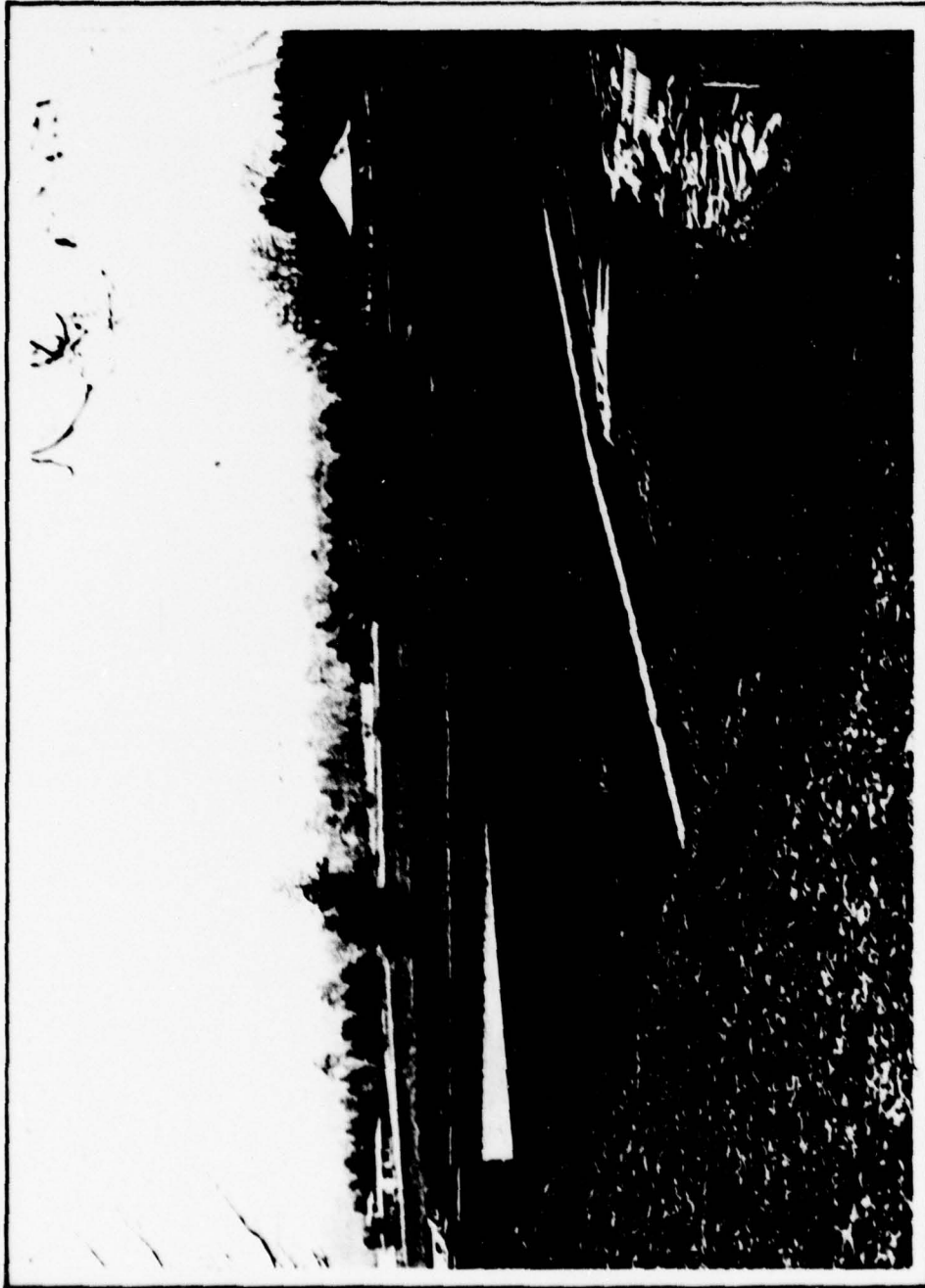


Date: June 8, 1979

James W. Peck
Approved By

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 16 July 1979



*OVERVIEW
HEMLOCK LAKE DAM, PIKE COUNTY, PENNSYLVANIA*

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
HEMLOCK LAKE DAM
NDI I.D. NO. 00399
DER # 52-71

SECTION 1

PROJECT INFORMATION

1.1 General

- a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.
- b. Purpose of Inspection. The purpose of this inspection is to evaluate the structural and hydraulic conditions of the Hemlock Lake Dam and to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

- ABSTRACT →
- a. Description of Dam and Appurtenances. (Supplemented by information obtained from the Pennsylvania Department of Environmental Resources, Division of Dam Safety, Harrisburg, Pennsylvania).

Hemlock Lake Dam is an earth embankment with a concrete core wall. The embankment is about 625 feet long with a maximum height of approximately 14 feet. The top width of the dam is a minimum of 150 feet and the earth embankment side slopes are 3 horizontal to 1 vertical (3H:1V) both upstream and downstream. The top of the dam is used as a golf course fairway.

A drop spillway, with a round crested weir, is located adjacent to the right (looking downstream) abutment. The crest of the weir is 3 feet below the top of the dam, and the length of the weir is 47 feet. The drop spillway is of stone masonry construction except for the rounded weir crest section which is poured concrete. The distance from the drop spillway weir crest to the apron is about 7 feet. The apron is 20 feet long and slopes down from each side wall. The transverse end sill is of negligible height at the side walls and is about 2 feet high in the center. Two 24-inch semi-circular corrugated steel pipes are constructed into the end sill and act as control structures. Flow passes over the drop spillway, through the two corrugated pipes, and into Lower Lake. ←

ABSTRACT

The reservoir drain system is located about 320 feet left (looking downstream) of the drop spillway. It consists of a gate house, a gate

valve, and a 24-inch cast iron reservoir drain pipe. There is a reinforced concrete catwalk to the gate house.

- b. Location. Hemlock Lake Dam is located on an unnamed tributary of Bush Kill within Hemlock Farms, a recreational development, in Blooming Grove Township, Pike County, Pennsylvania. The dam site is approximately 3.5 miles northeast of Pecks Pond, Pennsylvania, and is shown on USGS Quadrangle, entitled, "Pecks Pond, Pennsylvania", at coordinates N 41° 17.6', W 75° 02.7'. A regional location plan of Hemlock Lake is enclosed as Plate 1, Appendix E.
- c. Size Classification. The dam is classified as "Intermediate" size based on its storage capacity of 1,385 acre feet.
- d. Hazard Classification. The dam is classified as a "High" hazard structure. This is consistent with its potential in the event of failure for extensive property damage and probable loss of life along the shores of Blue Heron Lake which is located a mile downstream of Hemlock Lake Dam.
- e. Ownership. Hemlock Lake Dam is owned by Home Smith International Ltd. (Hemlock Farms), Lords Valley, Hawley, Pennsylvania, 18428.
- f. Purpose of Dam. The reservoir is used for water based recreation by residents of Hemlock Farms.
- g. Design and Construction History. The application to construct Hemlock Lake Dam was submitted on August 29, 1928, by William J. Brewster. The "Report Upon the Application of William J. Brewster" was prepared on September 12, 1928, by the Commonwealth of Pennsylvania. The permit to construct Hemlock Lake Dam was issued by the Commonwealth of Pennsylvania on September 26, 1928. Construction began on May 22, 1929, and the structure was completed during the Fall of 1930. Final inspection of the project was made on December 18, 1930.

The structure was designed by W. W. Blauvelt and C. B. Hoppe, professional engineers registered in the State of New Jersey. The spillway that now exists is not the same as shown on the drawings and in photographs taken during and shortly after construction. The representative of the owner reported that there are no plans and construction history of the existing spillway structure.

- h. Normal Operating Procedures. According to the owner's representative, the reservoir is normally maintained at Elevation 1439.0. Normal discharge is through the 24-inch cast iron reservoir drain pipe. Inflow occurring when the reservoir level is at or above the drop spillway crest elevation is discharged over the drop spillway.

1.3 Pertinent Data

a. Drainage Area.

Square Miles	1.18
--------------	------

- b. Discharge at Dam Site. According to the Owner's representative, the maximum known flow at the dam site was about 285 cfs. during the Agnes storm of June, 1972. The depth of flow was approximately 1.5 feet over the weir of the drop spillway. The drop spillway capacity is about 800 cfs. with water in the reservoir at the top of the dam.

c. Elevation (Feet, USGS Datum).

Top of Dam	1442.0
Maximum Pool of Record	1440.5
Crest of Drop Spillway, Normal Pool	1439.0
Streambed at Centerline of Dam	1428.0
Maximum Tailwater	1435.0+

d. Reservoir (Miles).

Length of Maximum Pool, Top of Dam	0.99
Length of Recreation Pool (Normal Pool)	0.98

e. Storage (Acre Feet).

Crest of Drop Spillway, Normal Pool, Elevation 1439.0	918
Top of Dam, Elevation 1442.0	1,399

f. Reservoir Surface (Acres).

Crest of Drop Spillway, Normal Pool, Elevation 1439.0	122
Top of Dam, Elevation 1442.0	142

g. Dam.

Type	Rolled earth with concrete corewall.
Length	450 Feet
Height	14 Feet (maximum)
Top Width	150 Feet (minimum)
Side Slopes	Upstream 3H:1V
	Downstream 3H:1V
Zoning	None
Impervious Core	Concrete
Cutoff	Concrete
Grout Curtain	None

h. Diversion and Regulating Tunnel.

Does not apply to this site.

i. Spillway.

Type

Length of Weir
Crest Elevation
Gates

Drop Spillway with Round
Crested Weir.

47 Feet
1439.0 Feet MSL
None

j. Regulating Outlets.

Reservoir Drain

24" diameter cast iron pipe
with gate valve.

SECTION 2

ENGINEERING DATA

2.1 Design

- a. Data Available. A summary of engineering data on Hemlock Lake Dam is presented in the checklist which is part of Appendix A. Principal documents obtained from DER containing pertinent data for this report are as follows:

1. Application, Report on the Application, and Permit to construct Hemlock Lake Dam.
2. Construction progress reports.
3. Photographs made during construction and in the years following.
4. Drawings of limited value. There are no drawings of the present drop spillway.

Note: Design data are not available.

- b. Design Features. The principal design features for the structure are shown on the drawings enclosed in Appendix E as Plates 2 through 4. A description of the features is discussed in Section 1.2.a.

2.2 Construction

Based on review of the documentation in the DER files, examination of the limited design drawings, and discussions with the Owner's representative, it is concluded that the dam was built as proposed. However, according to the Owner's representative, no documentation is available concerning the replacement of the original spillway structure (refer to item 1.2.g).

2.3 Operation Data

According to the Owner's representative, there are no formal operating procedures for the dam.

2.4 Evaluation

- a. Availability. All engineering data reproduced in this report and studied for this investigation were provided by DER and supplemented by conversations with the Owner's representative.

- b. Adequacy. The information made available by DER, conversations with the Owner's representative and observations made during the field investigation provided adequate data for a Phase I evaluation.
- c. Validity. There is no reason to question the validity of the data presented.

SECTION 3

VISUAL INSPECTION

3.1 Findings

- a. General. The field inspection of Hemlock Lake Dam took place on November 21, 1978. At the time of the inspection, the reservoir surface elevation was approximately 1.0 foot below the crest of the drop spillway. The observations and comments of the field inspection team are in the checklist which is Appendix B of this report.
- b. Dam. The dam appears to be in good condition. The top of the dam is used as a golf course fairway and it is well maintained. There are a few small animal burrows and a few small birch trees on both the upstream and downstream earth embankment slopes. Because of its use as a golf course fairway, the dam has a minimum top width of 150 feet. The earth embankment slopes are approximately 3H:1V, both upstream and downstream. The riprap facing on both the upstream and downstream earth embankment slopes is well graded and shows no signs of deterioration.
- c. Appurtenant Structures. The gate house is evidently well maintained. The Owner's representative reported that the reservoir drain gate valve is functional, but he was unable to operate it during the inspection because he did not have the gate valve hoist wheel.

The drop spillway appears to be in good condition and shows no sign of horizontal or vertical misalignment. The spillway of the original structure has been replaced.

- d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of siltation, slope instability, or other features that would affect the storage capacity of the reservoir.

The slopes on the perimeter of the reservoir are well vegetated, a good percentage of which are well maintained lawns.

- e. Downstream Channel. Lower Lake is located immediately downstream of Hemlock Lake, and has a surface area of 23 acres at a normal pool elevation approximately 7 feet below that of Hemlock Lake. The channel immediately downstream of the Lower Lake Dam is poorly defined, with swampy overbank areas. From about 500 yards downstream of Lower Lake to Blue Heron Lake, the stream is on a grade in excess of 4 percent. Blue Heron Lake Dam impounds a 90 acre reservoir. The dam is provided with two concrete spillways and a low level outlet. (See photo on page 6 of Appendix D). Approximately 50 houses are located along the shore line of Blue Heron Lake.

SECTION 4

OPERATIONAL FEATURES

4.1 Procedures

Operational procedures have been covered in Section 1.2.h. The Hemlock Farms Community Organization (HFCO), the group responsible for the operation and maintenance of the structure, does not have written operating procedures.

4.2 Maintenance of the Dam

According to the Owner's representative, normal maintenance consists of keeping the drop spillway free of debris, keeping vegetation cut on the dam, and being alert for any deterioration of the structure.

4.3 Maintenance of Operating Facilities

According to the Owner's representative, the gate valve is maintained by the HFCO. The HFCO does not have written maintenance procedures.

4.4 Warning System in Effect

There is no formal warning system or procedure established to be followed during periods of heavy precipitation. A representative of HFCO should be in the vicinity and available to warn residents of impending high flows.

4.5 Evaluation of Operational Adequacy

Based on the overall appearance of the dam and facilities, the maintenance procedures appear satisfactory for Hemlock Farms Dam.

The Owner's representative reported that the reservoir drain gate valve works, but he did not have the gate valve hoist wheel during the field investigation. It is recommended that the Owner assess the functional condition of the reservoir drain gate valve and exercise the valve periodically.

A formal warning system should be implemented because of the possibility of loss of life and significant property damage downstream in the event of a failure of the structure.

The dam is accessible under all weather conditions for inspection and emergency action.

SECTION 5

HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

- a. Design Data. The original design information is limited to statements in the Application Report dated September 12, 1928.

The drainage basin contributing to Hemlock Lake Dam is about 2 miles long and averages about 0.6 miles wide, with a total drainage area of 1.18 square miles. Ground elevations range from 1600 to 1439. The average slope of the drainage basin adjacent to the reservoir is about 10 percent. The drainage basin is 100 percent within the Hemlock Farms development. The runoff characteristics of the drainage basin should remain essentially the same in the future because the basin has been fully developed.

For further information refer to the computations, data, and printouts included in Appendix C.

- b. Experience Data. Rainfall and water level records are not kept for this dam. The owners representative said that in the June, 1972, Agnes storm the water surface was about 18 inches above the drop spillway crest (Elevation 1440.5).
- c. Visual Observations. On the day of the inspection, no adverse hydraulic features were observed that would prevent the drop spillway from operating in a satisfactory manner in the event of a severe storm.
- d. Overtopping Potential. The drop spillway has a total discharge capacity of about 800 cfs. before overtopping the dam. However, the Spillway Design Flood (SDF) for this "Intermediate" size dam with a "High" hazard classification is the PMF which has a peak inflow of 2890 cfs. and a peak outflow of 1860 cfs. The PMF hydrograph was routed through the reservoir with the starting water surface at Elevation 1439.0. The maximum water surface elevation in the reservoir from the PMF routing would be 3.8 feet above the drop spillway crest and 0.8 foot above the top of the dam. Examination of the results of the hydrologic and hydraulic analysis indicates that the drop spillway is capable of passing 67 percent of the PMF without overtopping of the embankment (see Appendix C for computations).
- e. Spillway Adequacy. The drop spillway is classified as "Inadequate" because it is capable of passing 67 percent of the PMF. It is not "Seriously Inadequate" because it passes more than 50 percent of the PMF.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations. Due to use as a golf course fairway, the dam is many times wider than shown on the plans and appears stable. Nothing observed during the field inspection would lead one to change that general impression. There were no signs of settlement, surface irregularity or seepage through the embankment or foundation.

The overall appearance of the drop spillway is also good with no visible signs of structural deficiencies or deterioration.

- b. Design and Construction Data. The material provided by DER was reviewed. A listing of this data is included in Appendix A and is discussed in Section 2.
- c. Operating Records. According to the owner's representative, there are no operating records maintained for this structure.
- d. Post - Construction Changes. The spillway of the original structure has been replaced, but no details of this work are available (refer to Section 1.2.g).

The earth embankment is at least seven times wider than the embankment shown on the 1930 drawings. It has been widened to create a golf course fairway.

- e. Seismic Stability. The dam is located in Seismic Zone 1 on the Seismic Zone Map of Contiguous States. A dam located in Seismic Zone 1 is generally considered to be safe under any expected Zone 1 earthquake loading conditions if it is safe under static loading conditions.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

- a. Safety. The visual inspection, review of the material furnished by DER, and conversations, with the owner's representative provided sufficient evidence that the dam and the appurtenant structures of the Hemlock Lakes Reservoir are in good condition. The hydrologic and hydraulic calculations presented in Appendix C show that the drop spillway will pass 59 percent of the PMF. Therefore, the drop spillway system of the structure is considered to be "Inadequate".
- b. Adequacy of Information. Refer to item 2.4.b.
- c. Urgency. The remedial measures recommended in Section 7.2 should be effected as soon as possible.
- d. Necessity for Further Evaluation. No further investigations are recommended at this time.

7.2 Recommendations and Proposed Remedial Measures

a. Facilities.

1. Small trees on the upstream and downstream slopes of the earth embankment should be cut at ground level.
2. Small animal burrows on the earth embankment should be filled with suitable material.
3. The operating condition of the reservoir drain gate valve should be assessed and the valve should be operated periodically.

b. Operation and Maintenance Procedures.

1. A warning system should be developed. During periods of heavy rainfall, the dam should be monitored and downstream residents alerted in the event of an impending failure.

APPENDIX

A

Check List Engineering Data
Design, Construction, Operation
Phase I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM

Hemlock Lake

ID # *PA 00399*

Sheet 1 of 4

ITEM

REMARKS

AS-BUILT DRAWINGS

There are no "As-Built" drawings, but DER files have 8 sheets of drawings of limited value.

REGIONAL VICINITY MAP

see Plate I, Appendix E. Blauvelt & Hoyne Engineers also provided a regional location plan for the dam.

CONSTRUCTION HISTORY

Construction progress reports prepared by engineers of the Water & Power Resources Board of the State of Pennsylvania are in the DER files.

TYPICAL SECTIONS OF DAM

Refer to Appendix E for drawing

OUTLETS - PLAN

DETAILS

CONSTRAINTS

Refer to Appendix E for drawings

DISCHARGE RATINGS

None available

RAINFALL/RESERVOIR RECORDS

None available

ITEM

REMARKS

DESIGN REPORTS

No design data available. 8 sheets of drawings of limited value in DER files.

GEOLOGY REPORTS

None provided in DER files. Refer to Appendix F of this report.

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

No data available
No data available
No data available
No data available

MATERIALS INVESTIGATIONS

BORING RECORDS
LABORATORY
FIELD

3 boring profiles shown in drawings.

POST-CONSTRUCTION SURVEYS OF DAM

None

BORROW SOURCES

There is no record of where borrow material came from

ITEM

REMARKS

MONITORING SYSTEMS

None

MODIFICATIONS

The embankment has been widened to at least seven times its original width. Minimum top width is now about 150 feet. The drop spillway has been completely rebuilt and rebreasted. There are no plans available for the present drop spillway.

HIGH POOL RECORDS

None. A representative of the HFCO said the highest known stage in the lake was in June 1972 when the water was about 13 inches above the crest of the drop spillway weir (Elev 1141.5)

POST CONSTRUCTION ENGINEERING
STUDIES AND REPORTS

None

PRIOR ACCIDENTS OR FAILURE OF DAM
DESCRIPTION
REPORTS

None

MAINTENANCE
OPERATION
RECORDS

Records were not made available to us. The structure, however, is kept in good maintenance.

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS	see Appendix E for details
DETAILS	

OPERATING EQUIPMENT
PLANS & DETAILS

See Appendix E for details

MISCELLANEOUS

Material in DER files:

1. "Application" to construct Hemlock Lake Dam, August 29, 1928
2. "Report Upon the Application of W.D. Brewster" was prepared on Sept. 12, 1928 by the State of Pennsylvania, Water & Power Resources Bd.
3. "Permit" to construct Hemlock Lake Dam, issued Sept. 26, 1928.
4. "Construction Progress Reports" prepared by Water & Power Resources Bd. State of Pennsylvania.
5. Dam Inspection reports through the years.
6. Photographs made during construction and through the intervening years.

APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Sheet 1 of 11

Name Dam Hemlock Lake County Dike State Pennsylvania National ID # 00399
Type of Dam Compacted Earth Fill Hazard Category High
Date(s) Inspection Nov. 21 & 22, '78 Weather Cold, Cloudy Temperature 30° - 35°F

Pool Elevation at Time of Inspection ± 1439.0 M.S.L. Tailwater at Time of Inspection ± 1431.0 A.S.L.

Inspection Personnel:

Leonard Beck Robert Boxiers David Campbell

Leonard Beck Recorder

Remarks:

David Koehel of the Hemlock Farms Community Organization
(HFCO) stopped by during our inspection

CONCRETE/MASONRY DAMS

Sheet 2 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

Sheet 3 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

Sheet 4 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

SURFACE CRACKS

None observed

None

UNUSUAL MOVEMENT OR
CRACKING AT OR BEYOND
THE TOE

None Observed

None

SLOUGHING OR EROSION OF
EMBANKMENT AND ABUTMENT
SLOPES

None observed

None

VERTICAL AND HORIZONTAL
ALIGNMENT OF THE CREST

No distortions
observed

None

RIPRAP FAILURES

None observed

None

EMBANKMENT

Sheet 5 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

DRAINS

None observed

None

JUNCTION OF EMBANKMENT
AND ABUTMENT, SPILLWAY
AND DAM

*No discontinuities observed
impossible to tell where golf
fairway begins & dam ends*

None

ANY NOTICEABLE SEEPAGE

None observed

None

STAFF GAGE AND RECORDER

None

None

OUTLET WORKS

Sheet 6 of 11

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

CRACKING AND SPALLING OF
CONCRETE SURFACES IN
OUTLET CONDUIT

None

None observed

INTAKE STRUCTURE

Trash rack
protection shown
on drawings

Under water at time
of investigation

OUTLET STRUCTURE

None

Under water at time
of investigation

OUTLET CHANNEL

None

No outlet channel.
Outlet flow goes directly
into lower lake

EMERGENCY GATE

N/A

BRIDGE

N/A

UNGATED SPILLWAY

Sheet 7 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CONCRETE WEIR	Good condition No spalling No obstructions	None
---------------	--	------

APPROACH CHANNEL	Good condition Stone masonry & concrete walls	None
------------------	---	------

DISCHARGE CHANNEL	No obstructions, very short average 30 feet long discharges into Lower Lake	None
-------------------	---	------

BRIDGE AND PIERS	N/A	
------------------	-----	--

GATED SPILLWAY

Sheet 8 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CONCRETE SILL	N/A	
---------------	-----	--

APPROACH CHANNEL	N/A	
------------------	-----	--

DISCHARGE CHANNEL	N/A	
-------------------	-----	--

BRIDGE AND PIERS	N/A	
------------------	-----	--

GATES AND OPERATION EQUIPMENT	N/A	
----------------------------------	-----	--

INSTRUMENTATION

Sheet 9 of 11

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION

MONUMENTATION/SURVEYS

None

None

OBSERVATION WELLS

None

None

WEIRS

None

None

PIEZOMETERS

None

None

OTHER

None

None

RESERVOIR

Sheet 10 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

SLOPES

Gentle to moderate,
well vegetated, no
signs of slides

None

SEDIMENTATION

Accumulation has not been
enough to adversely affect
any of the recreational uses
of the impoundment.

None

DOWNSTREAM CHANNEL

Sheet 11 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Immediately downstream is lower lake. The spillway for lower lake has a trash rack with small openings which will probably plug with high flow. Downstream of lower lake, the channel flows through a swamp, then a steep reach to a swamp again before emptying into Blue Heron Lake.	Remove the trash rack on the lower lake spillway.
SLOPES	Taken drop from spillway transverse sill to lower lake. Taken slope through swamp downstream of lower lake, then about 4% slope to swamp upstream of Blue Heron Lake.	None
APPROXIMATE NO. OF HOMES AND POPULATION	50 homes and approximately 250 people	A formal warning system should be developed and implemented. Procedures for evacuating people within the flood region of Blue Heron Lake should be implemented.

APPENDIX

C

Hydrologic & Hydraulic Data



O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT

Hemlock Lake Dam

SHEET

BY

DATE

JOB NO

Table of Contents APPENDIX C

Hydrologic & Hydraulic Data

<i>PMP Calculations</i> _____	<i>Sheet 1</i>
<i>Snyder coefficients</i> _____	<i>" 1</i>
<i>Hemlock Lake, stage vs. Storage</i> _____	<i>" 2</i>
<i>Hemlock Lake, stage vs. Discharge</i> _____	<i>" 3</i>
<i>HEC-I Dam Safety Version, Computer Printout</i> _____	<i>" 4</i>
	<i>HMIB</i>



O'BRIEN & GERE

SUBJECT

HEMLOCK LAKE DAM

SHEET

1

BY

RRB

DATE

1/12/79

JOB NO.

✓ 1/25/79

HEC 1, DAM SAFETY VERSION PROGRAM CALCULATIONS

DRAINAGE AREA: 1.18 SQUARE MILES

PMP CALCULATIONS (HMS REPORT 33)

AREA IS IN ZONE 1 OF PMP ALL SEASON ENVELOPE (FIG. 1)

24 HR., 200 SQ. MI. RAINFALL \cong 21"

<u>HR.</u>	<u>%</u>	<u>RAINFALL</u>	<u>Δ RF</u>
6	111	23.3 "	23.3 "
12	123	25.8 "	2.5 "
24	133	27.9 "	2.1 "

SNYDER COEFFICIENTS

FROM INFO. PROVIDED BY COE, (Zone 1)

$$C_p = 0.45$$

AND $C_t = 1.23$

$$t_p = C_t (L \cdot L_{ca})^{0.3}$$

$$L \cong 1.70 \text{ miles}$$

$$L_{ca} \cong 0.6 \text{ miles}$$

$$t_p = 1.23 (1.7 \cdot 0.6)^{0.3} = 1.24 \text{ HR.}$$

SUBJECT

Hamlock Lake Dam, Stage vs. Storage

SHEET

2

BY

J

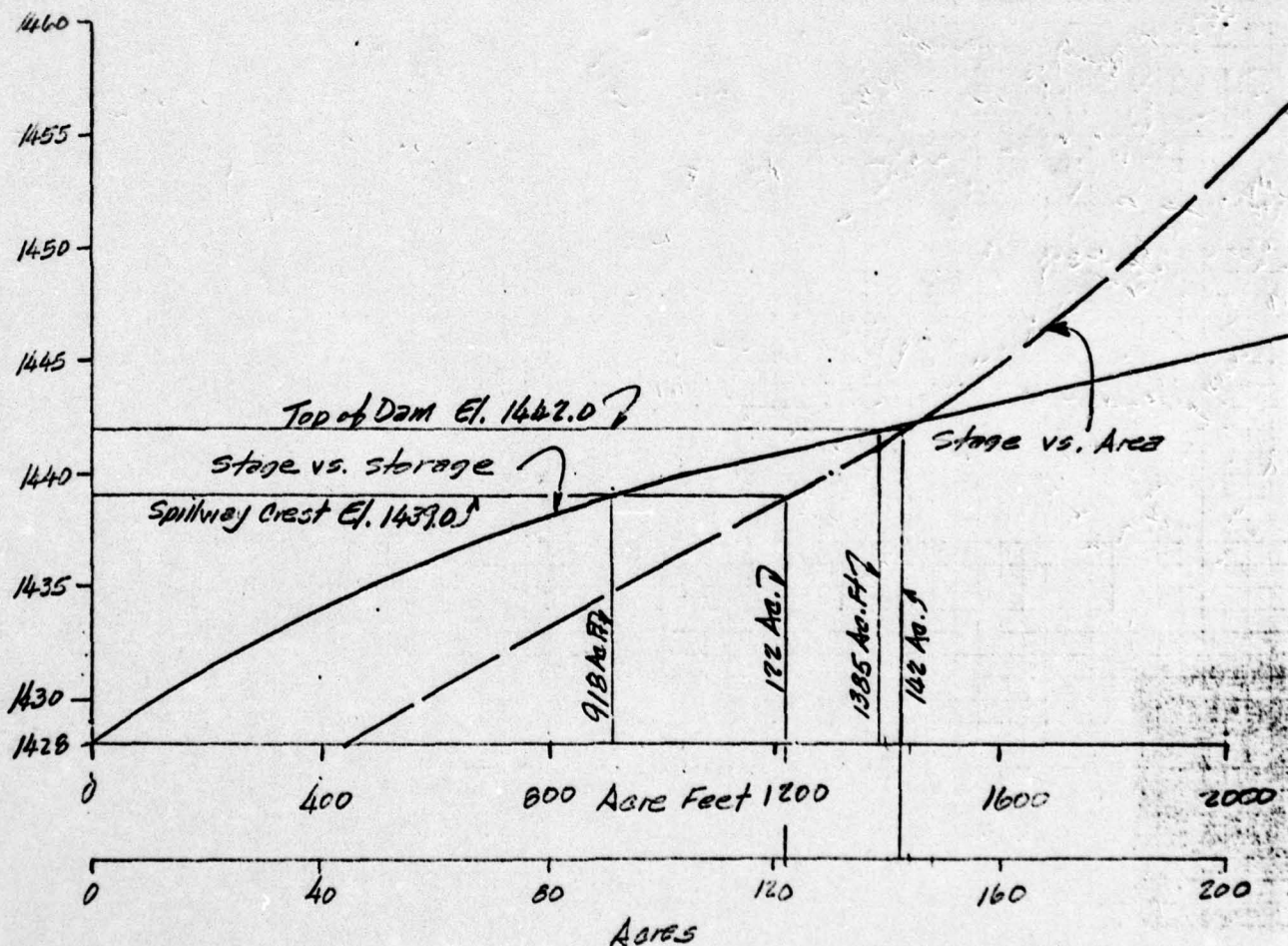
DATE

12/11/78

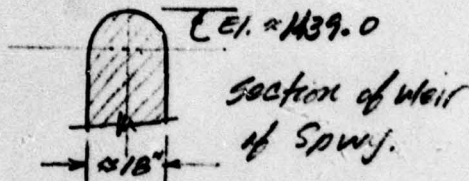
JOB NO

52-71

Elev. ① (Center of Lake)	Area (in. ²) From Prev. St.	Area (Acres) ② = 91.827	Diff. Elev. (Ft.)	Vol. (A.F.)	Σ Vol. (A.F.)
1428.0	—	45 (Assumed)			
1439.0 Normal pool	1.33	122	11	918	918
1440.0	1.42	130	1	126	1044
1460.0	2.45	225	20	3550	4594



SUBJECT <i>Hemlock Lake Dam, Stage vs. Discharge</i>	SHEET <i>3</i>	BY <i>LB</i>	DATE <i>12/12/75</i>	JOB NO. <i>52-71</i>
---	-------------------	-----------------	-------------------------	-------------------------



section of weir
of Spwj.

A weir flow coefficient of 3.3 will be used.
This value was arrived at after referring to
SCS NEH-5, King's Hydraulic Hdbk. & transferring
with fellow staff members of 0.46.
rounded, 47' long, $CL = 3.3 \times 47 = 155.1$

Elev.	CL	h	$h^{3/2}$	Q
1439.0	155.1	0	0	0
1439.5	"	0.5	0.354	55
1440.0	"	1.0	1.0	155
1441.0	"	2.0	2.83	439
1442.0	"	3.0	5.20	807 Top of Dam

Sheet 4

.....
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAY SAFETY VERSION JULY 1978
 LAST MODIFICATION 25 SEP 78

RUN DATE 06/07/79.
 TIME 07:30:16.

NATIONAL DAM INSPECTION PROGRAM
 HEMLOCK LAKE DAM
 PMF HYDROGRAPH

Sheet 5

JOB SPECIFICATION
 NO. 150 NHR 0 NMN 30 IDAY 0 INR 0 IMIN 0 METRC 0 JPLT 0 IPRT 0 NSTAN 0
 JOPER 0 NMT 0 LROPT 0 TRACE 0

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 1 NRTIO= 9 LATIO= 1

RTIOS= .20 .30 .40 .50 .60 .70 .80 .90 1.00

SUB-AREA RUNOFF COMPUTATION
 RUNOFF TO RESERVOIR

ISTAQ 1C34P IECON ITAPE JPLT JPRT INAME ISTARE IAUTO
 A1 0 0 0 0 1 0 0

HYDROGRAPH DATA
 INYDG IUMG TAREA SNAP TRSDA TRSPC RATIO ISHOW ISAME LOCAL
 1 1 1.20 0.00 1.20 0.00 0.000 0 0 1 0

PRECIP DATA
 SPFE PMS R6 R12 R24 R48 R72 R96
 0.00 21.00 111.00 123.00 133.00 0.00 0.00 0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA
 LROPT STRKR DLTGR RTIOL ERAIN STRKS RTIOK STRTL CNSTL ALSMK RTIMP
 0 0.00 0.00 1.00 0.00 0.00 1.00 1.00 .05 0.00 0.00

UNIT HYDROGRAPH DATA
 TP= 1.24 CP= .45 NTA= 0

RECESSION DATA
 STRTO= -1.50 ORCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 23 END-OF-PERIOD ORIGINATES, LAG= 1.24 HOURS, CP= .45 VOL= 1.00
 67. 298. 265. 172. 135. 105. 64. 50.
 39. 31. 24. 19. 15. 11. 7. 4.
 3. 3. 2.

END-OF-PERIOD FLOW

MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP 0 MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP 0
 SUM 22.34 20.49 1.85 33214.
 (568.11 521.11 47.11 949.52)

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

Sheet 7

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS									
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9	
				.20	.30	.40	.50	.60	.70	.80	.90	1.00	
HYDROGRAPH AT	A1	1.20 (3.11)	1	579. (16.30)	868. (24.58)	1157. (32.77)	1447. (40.97)	1736. (49.16)	2025. (57.35)	2315. (65.55)	2604. (73.74)	2893. (81.93)	
	A2	1.20 (3.11)	1	207. (5.86)	323. (9.15)	439. (12.43)	598. (16.94)	723. (20.48)	888. (25.15)	1210. (34.27)	1520. (43.04)	1862. (52.74)	

PLAN 1

SUMMARY OF DAM SAFETY ANALYSIS

Sheet 8

RATIO OF PPF	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	TIME OF MAX OUTFLOW HOURS	DURATION OVER TOP HOURS	MAXIMUM OUTFLOW CFS	MAXIMUM STORAGE AC-FT	MAXIMUM DEPTH OVER DAM	MAXIMUM RESERVOIR W.S.ELEV	TIME OF FAILURE HOURS
	918. 0.	1439.00 918. 0.	1439.00 918. 0.	1442.00 1399. 807.							
.20	1440.18	0.00	1077.	207.	0.00	0.00	20.50	0.00	0.00	0.00	0.00
.30	1440.59	0.00	1149.	323.	0.00	0.00	20.00	0.00	0.00	0.00	0.00
.40	1441.00	0.00	1221.	439.	0.00	0.00	20.00	0.00	0.00	0.00	0.00
.50	1441.36	0.00	1285.	598.	0.00	0.00	20.00	0.00	0.00	0.00	0.00
.60	1441.74	0.00	1353.	723.	0.00	0.00	20.00	0.00	0.00	0.00	0.00
.70	1442.11	.11	1419.	800.	2.50	2.50	20.00	0.00	0.00	0.00	0.00
.80	1442.38	.38	1467.	1210.	4.00	4.00	19.50	0.00	0.00	0.00	0.00
.90	1442.50	.50	1503.	1520.	5.00	5.00	19.50	0.00	0.00	0.00	0.00
1.00	1442.78	.78	1537.	1862.	5.50	5.50	19.00	0.00	0.00	0.00	0.00

APPENDIX

D

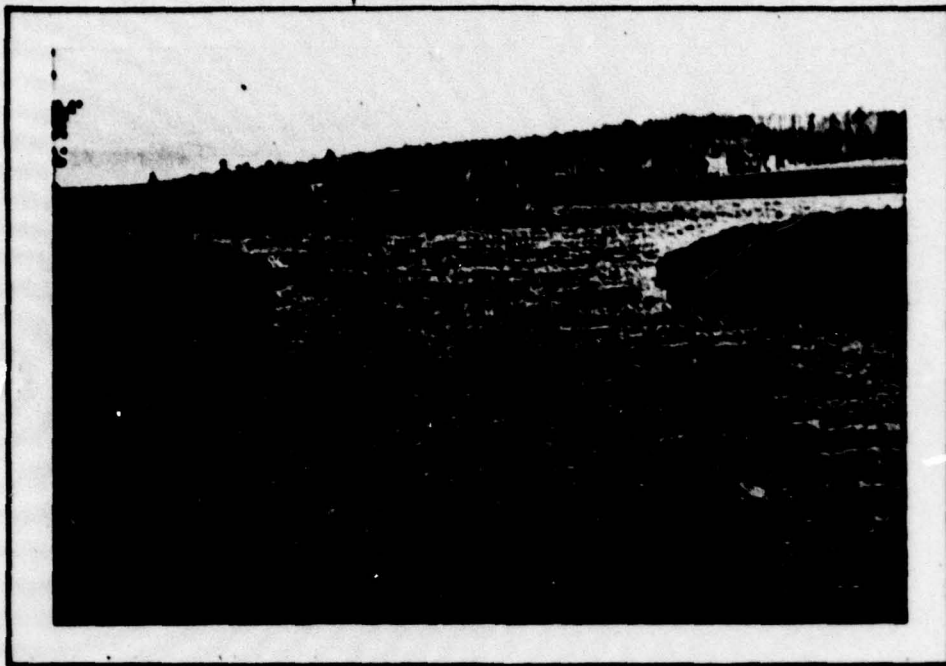
Photographs



***VIEW ALONG LENGTH OF DAM WHICH
IS ACTUALLY A GOLF FAIRWAY***



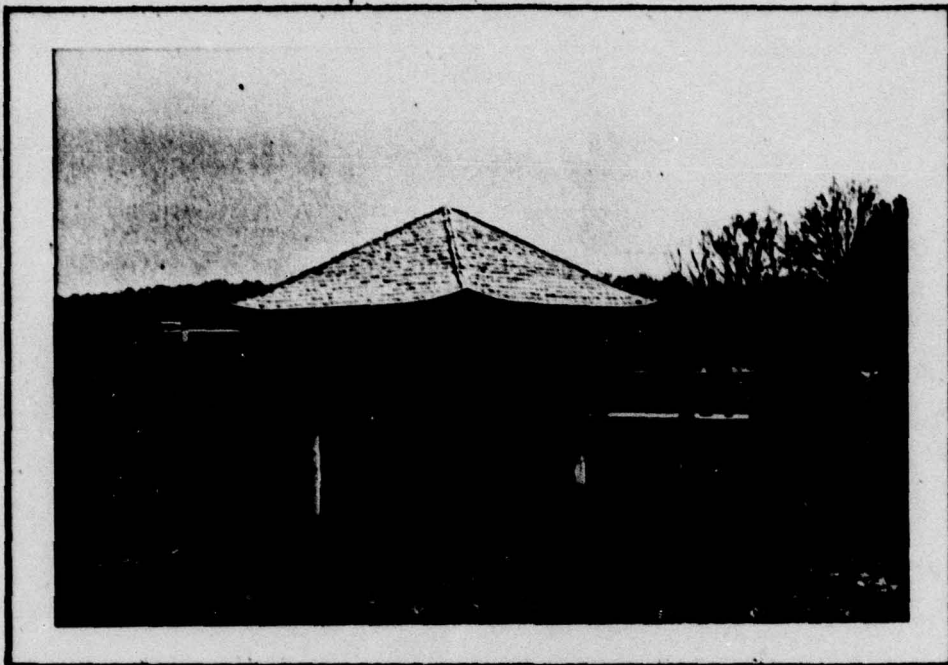
UPSTREAM FACE OF DAM



APPROACH CHANNEL TO DROP SPILLWAY



**VIEW ACROSS HEADWALL
OF DROP SPILLWAY**



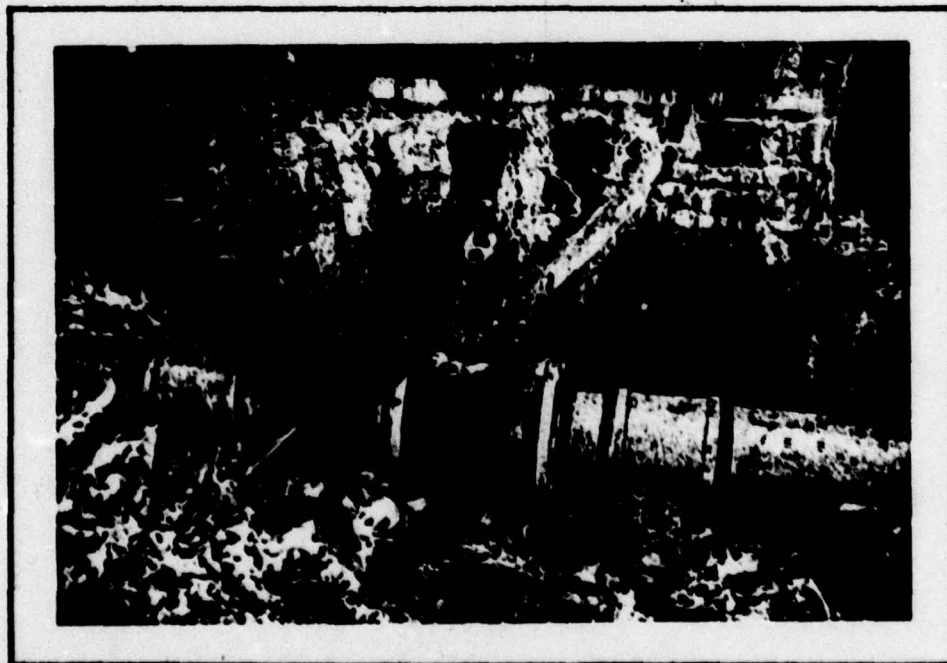
*PAGODA SHELTER BUILT ON TOP OF
RESERVOIR DRAIN GATE VALVE TOWER*



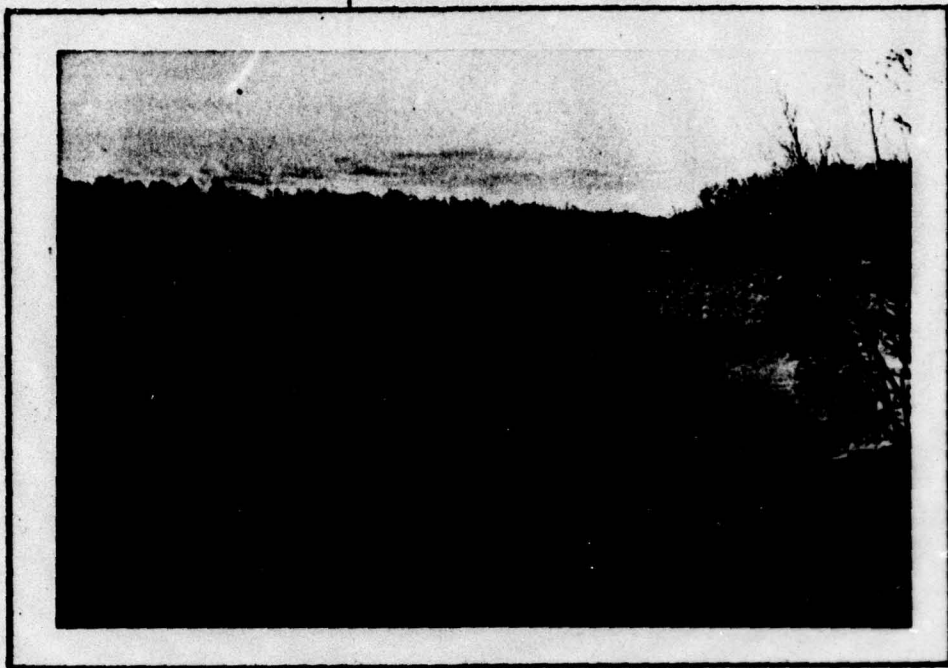
*RIPRAPPED RIGHT SIDE OF
DROP SPILLWAY APRON*



*DRAIN PIPES THROUGH TRANSVERSE
SILL OF DROP SPILLWAY*



*WATER MAIN VALVE NEXT TO HEADWALL
IN APRON OF DROP SPILLWAY*



**LOWER LAKE IMMEDIATELY
DOWNSTREAM OF HEMLOCK LAKE DAM**



**LOWER LAKE DAM 400 YARDS DOWNSTREAM
OF HEMLOCK LAKE DAM**



**BLUE HERON LAKE DAM 2 MILES
DOWNSTREAM OF HEMLOCK LAKE DAM**



**DEVELOPMENT ALONG SHORE OF BLUE HERON LAKE
ABOUT 2 MILES DOWNSTREAM OF HEMLOCK LAKE DAM**

APPENDIX

E

Drawings



O'BRIEN & GERE

SUBJECT

Hemlock Lake Dam

SHEET

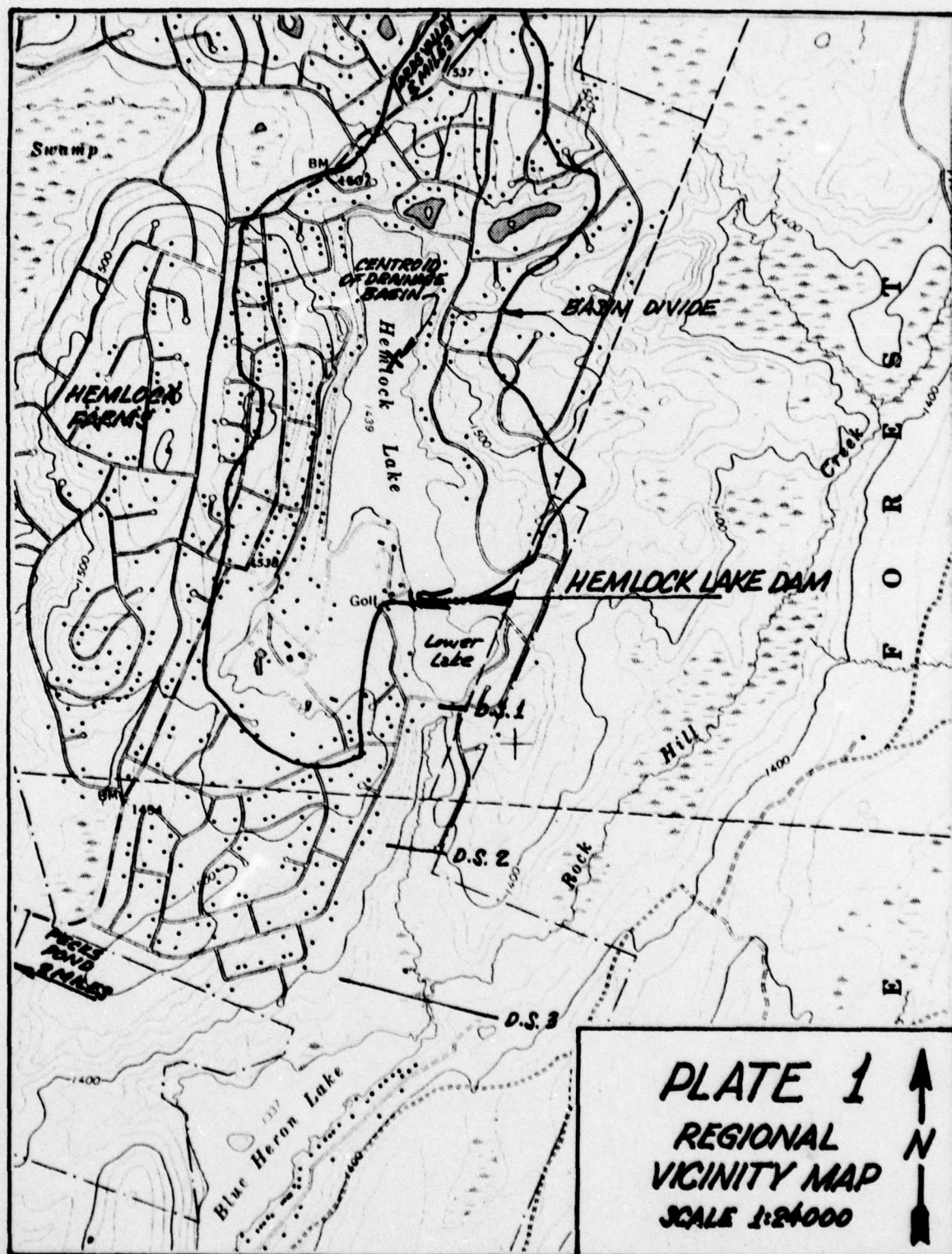
BY

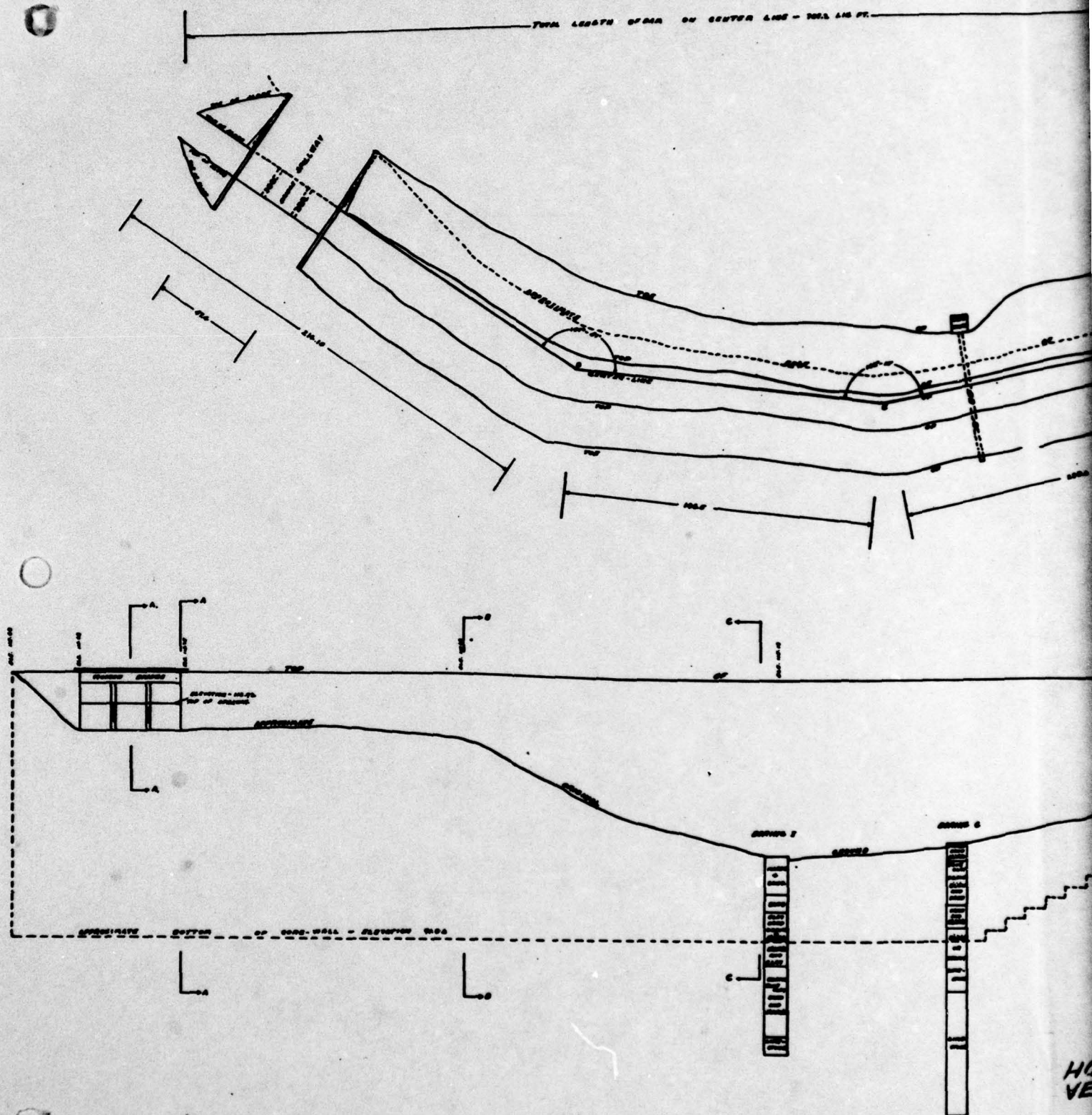
DATE

JOB NO.

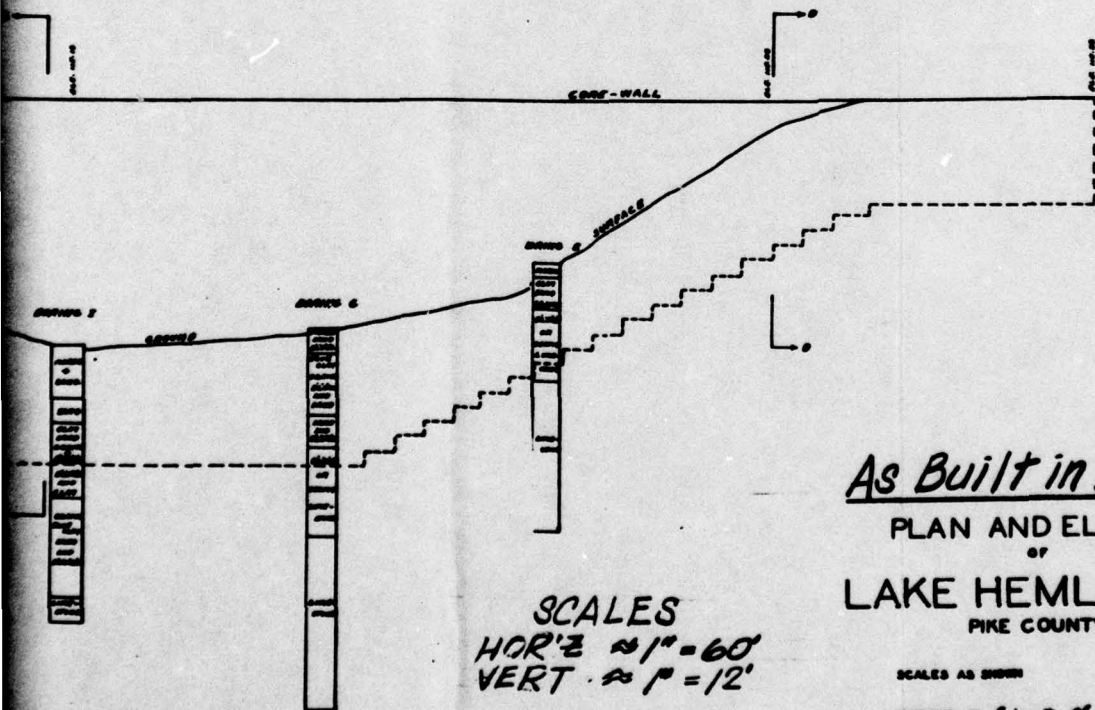
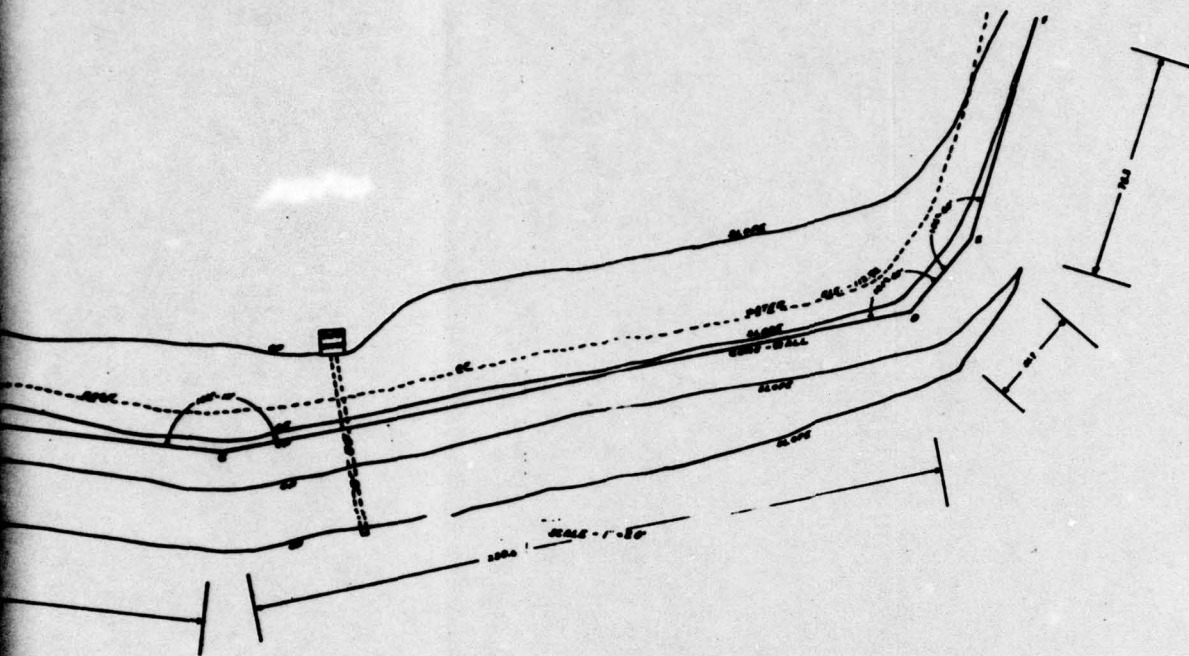
APPENDIX "E" Table of Contents

Regional Vicinity Map	Plate 1
Plan & Elevation of Dam as of 1930	Plate 2
General Plan of Dam, 1978	Plate 3
Profile along Centerline of Dam, 1978	Plate 4
Location Plan, 1928	Plate 5





UPPER 4.000 - 200.0 4.000 FT.



SCALES
HOR'Z 1" = 60'
VERT 1" = 12'

As Built in 1930

PLAN AND ELEVATION
OF
LAKE HEMLOCK DAM
PIKE COUNTY, PA.

SCALES AS SHOWN

DECEMBER 1930.

2

PREPARED BY - *Edwin R. Chapman* - L.E. NO. 2000. R.A.

APPROVED - _____ - L.E. NO. 1000. R.A.

SHEET NO. 1

PLATE NO. 2

DATE	BY	DATE	BY	DATE	BY
4/10/79	dy				
Hemlock Lake Dam as of 11/78					

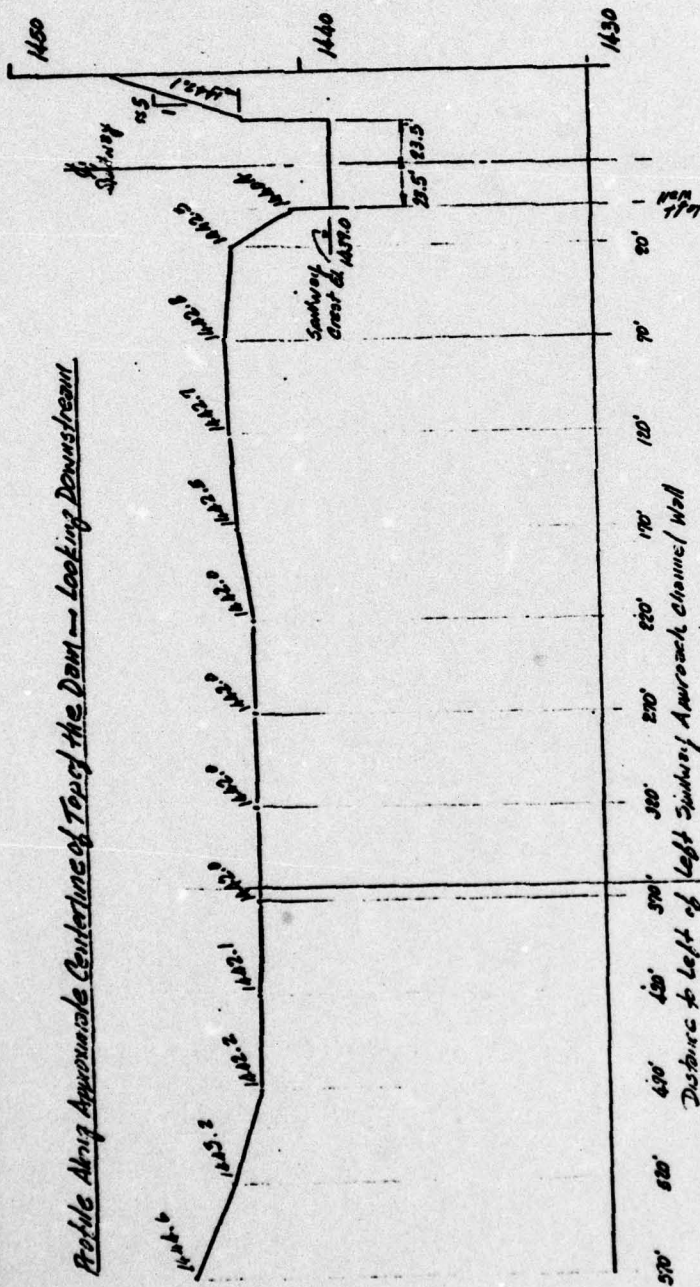


HEMLOCK LAKE DAM
GENERAL PLAN
FROM FIELD INSPECTION NOTES
FIELD INSPECTION DATE 4/21/78
PLATE NO. 9



DATE	TIME	JOB NO	CONTACT	BY	DATE
11/17/78	3:20	1178	Hemlock Lake Dam		

Profile Along Approximate Centerline of Top of the Dam -- Looking Downstream



Scales

HEMLOCK LAKE DAM
PROFILE ALONG APPROX. CENTERLINE OF CREST OF DAM
FROM FIELD INSPECTION NOTES
FIELD INSPECTION DATE: NOV. 21, 1978
PLATE NO. 4

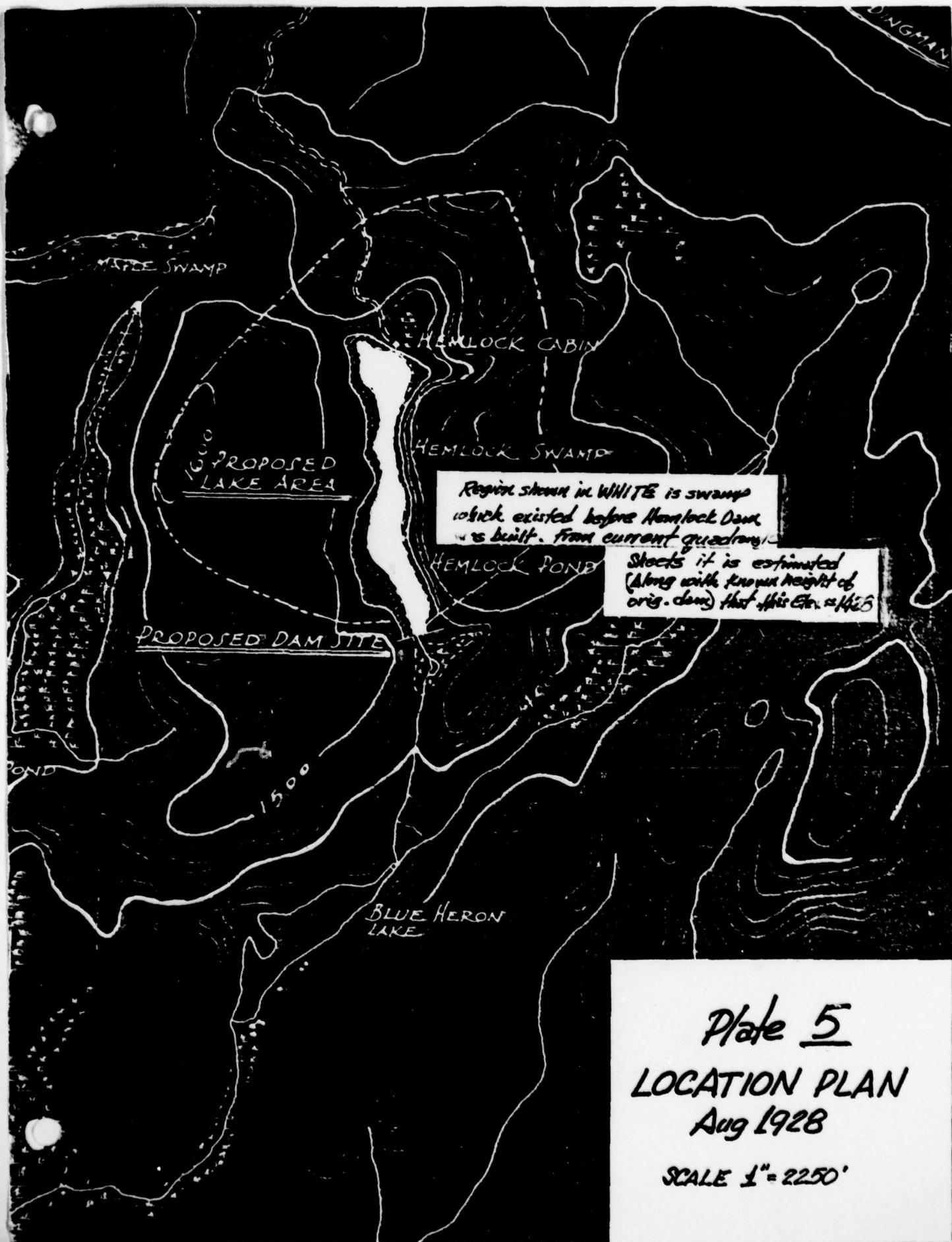


Plate 5
LOCATION PLAN
Aug 1928

SCALE 1" = 2250'

APPENDIX

F

Site Geology

SITE GEOLOGY

HEMLOCK LAKE DAM

Hemlock Lake Dam is situated in Pike County and within the limits of the Eastern Glaciated section of the Appalachian Plateau physiographic province. Thick deposits of glacially derived rock debris and till mask the underlying near horizontally bedded, red, gray and green shale and sandstone units of the Devonian Catskill group of continental sediments. The dam and lake both rest on glacial till and ground moraine deposits which are dense and compact. The reservoir lies in areas previously covered with high valley swamps and bogs. These features, overlying the dense, compact till, attest to the impervious quality of these sediments.

No known faults or major structural defects are known to occur in the foundation materials in the vicinity of the dam and lake.

It should be noted that core borings shown on the design plan dated December 1930, prepared for construction of Lake Hemlock Dam indicate the presence of limestone in the foundation. For the record it is considered that such is not the case since the occurrence of limestone in the Catskill formation units in Pike County is highly improbable.

